THE FOUNDRY

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Foundry Management.

BY DWIGHT TRUESDALE.

IT has often occurred to the writer that the subject of "Foundry Management" has not in many cases received the attention by those most interested, that its importance entitles it to. The nature of the business and the fact that there are not and neither can there be any fixed rules to govern the molder in his work, makes the question of "Foundry Management" in the best sense of the term, one of considerable difficulty. In these days of close competition, with an increasing demand for a better class of castings at a minimum cost, together with the fact that unlike almost every other branch of mechanical industry, the foundryman cannot, except at very few stages of the process, call to his aid any of the helps of labor saving machinery, often makes the problem a very difficult one.

There are none of the mechanical branches that have to depend so much on the judgement and skill of the man as that of molding; this applies especially to stove manufacturing, as this class of castings must be made so that they will "mount" with the least labor and expense. It would seem, therefore, that the subject of "Foundry Management" is one of the greatest importance to those interested. I therefore propose to consider what in my opinion is necessary to secure it in the highest degree.

Good management implies, first of all, a good manager; and this brings us to the question, "What are the necessary requisites to constitute the ideal manager?" To better explain my idea of what I consider necessary to fit a man for the position, I propose to classify under different heads some few of the qualifications that he ought to possess to be successful.

MECHANICAL SKILL.

He must be a molder. By this I mean he must not be of that class, of which unfortunately, there are so many in these days, where knowledge of the trade is confined to the making of certain parts of a stove, but he must be able to mold all parts of a stove and at the same time know how to impart his knowledge to those under his charge in such a manner that the dullest man can comprehend. At the same time the man should have explained to him, in case he fails to make good castings, the reasons for such failure, and be shown by practical illustration the way to do it, and be told why it is the best way. Hence the necessity for a manager to be a good molder.

A foundry manager cannot command the respect of the men under his charge if they once understand that they know more about the business than he does. I know that there are many holding the position that have no practical knowledge of molding and are, in a measure, successful; but I think that the proposition holds good, that to show another how to do a thing, you must first know yourself.

PATTERNMAKING.

The first stage in the foundry is the pattern shop, and here the practical molder's knowledge comes in to the benefit of both employer and molder. He must be able to "read a drawing" and advise with the draftsman as to the best and cheapest way to design the pattern, with an eye to what is to come when the pattern is on the sand, that is consistent with the style of stove that it is desired to make, so that when the patterns are ready they will be constructed with a

regard for detail, that the least difficulty will be had in molding them, consequently making castings that can be mounted with the least labor and expense. I know that it is generally presumed that the draftsman "knows it all," and to take advice from a molder is beneath his dignity, but experience tells me that a molder who understands his business can materially aid a draftsman in designing his patterns so that they will mold easily and well, and consequently cheaper.

I do not wish to be understood as casting any reflection on draftsmen, as I have generally found them reasonable men, and when once it is explained to them by one who is competent, some of the difficulties that are encountered by the molder, and that in many cases a slight modification of the drawings will make no material change in the result, at the same time simplifying the work, they will generally be found ready to accept suggestions if properly presented.

And here comes the time when a practical knowledge of the business is important. Every foundryman knows by what has often been a costly experience, something of the troubles arising from faulty construction of patterns, causing them to crack when put into use, and often before leaving the foundry. The manager should be able to see as the work progresses, where the weak points are, and have them remedied before the iron patterns are made.

The making of iron patterns is the next stage, and here great care and skill are required of the molder, and the manager must be able to direct him as to the best way to make them. Especial care must be taken in "gating" them, so that the casting will be straight and of an even thickness, together with an absence of hard, glassy spots that cannot be filled, which increases the liability to break when in use, and what is of vital importance, see they are of the proper weight. It requires a very high order of mechanical skill to produce a perfect iron pattern from the wood and to know how to do this is one of the necessities of the position.

When the iron patterns go to the filer and fitter, vigilance is still the watchword, as unless care is taken, what are good patterns up to this point may, in the hands of incompetent men, be almost ruined for practical use, and after being put into the hands of the molder, will require going over again at increased expense, and in many cases it will be found that they cannot be fixed properly and so will continue to be a source of trouble as long as they are used. There is no one more competent to detect mistakes at this stage and know how to prevent them than the good, practical molder. It is not necessary to go into details about the many imperfections in filing such as making a "back draft," filing under the base of flanges, etc., as every molder knows them to his sorrow.

Great care must be taken in properly fitting the pattern, so that in mounting the least expense will be incurred; and to do this properly a practical knowledge of molding is necessary, as without it no one can tell how the castings are likely to come, and as a consequence trouble will be met with when the mounter gets them, and the result is unsatisfactory and expensive.

CARPENTER WORK.

The next step in the work is the carpenter shop, where there is still room for close watching, as the proper boarding of patterns is of as much importance as what has so far been done. By correct "boarding" I mean that the prime idea must not be lost sight of, and that is, "what can be done to facilitate and cheapen the molding?" Good judgment must be shown as to the number of pieces on a board, and what pieces shall be put on the same board, so that the work can be divided among molders of different degrees of skill, to the best advantage for all concerned. The carpenter must be instructed how to place his patterns on the board with an eye to economy of space, as well as the manner in which they will have to be gated. The same rules apply to the making of flasks, which should require no more sand than is necessary, as every pound of sand that is superfluous is so much labor lost, and in a year's work of 100 molders represents so many "foot

pounds" of labor from which there are no returns.

THE MOLDING ROOM.

The patterns and flasks are now ready for the molder, and here the closest vigilance is required, for without good castings it is impossible to produce good stoves, and from the fact as before stated, that there are no well established rules for the government of the molder, that in the molding room is brought out to the fullest extent the capabilities of the foundry manager. He should give this part of the work his greatest attention, as it is the most important place in the concern, for if poor castings are made from any cause, the evil cannot be remedied by the work that is yet to follow, without increased expense, and at the best no amount of work by the mounter can make up for bad castings. There are many foundries where the molder is allowed to do pretty much as he pleases as to the best manner of doing his work, especially in the matter of using facings, gating, and other similar matters, so that each individual molder is a "law unto himself," and in consequence the results are a lack of uniformity in the castings, which is very unsatisfactory. In this matter there should be one head to direct the best manner of making the work, and see that it is done that way. There are no other class of mechanics so slow to adopt new ideas as the molder, and this makes the position of manager one of great difficulty.

SELECTION OF SAND.

A vital question is the proper sand to use to obtain the best results, for without it good work is impossible. I do not propose to discuss the relative merits of the different grades of sand further than to say that the sand containing the largest proportion of silica, together with the smallest amount of limes, are the two first requisites necessary to produce fine grained castings; of course, there must be sufficient loam present to form a "bond." One of the greatest troubles that foundrymen encounter in producing fine castings arises from the fact that the sand question is not given proper attention.

The prevailing impression that castings up to 1,000 pounds in weight can not be made in fine or "stove" sand, is a false one. The writer has seen castings of that weight of an intricate character made in the same sand that was used to make all kinds of stove plate, with perfect success, castings being made without a blemish, resulting in a large saving when they came into the hands of the fitter.

CARE OF PATTERN.

There is no part of the foundry business that, unless carefully looked after, is a source of greater expense than careless handling of patterns. Many molders seem to have little or no appreciation of the importance of being careful in their use, or very little knowledge of their cost or value, and unless held to a certain amount of responsibility, the bill for repairs in the course of a year, aside from the direct loss by the increased weight owing to unsightly patches, is a considerable one.

The good manager will see that molders do not rap patterns with "draw hooks," with large rings or heads on them, as the continued rapping in one place, no matter how light the blow, finally results in the disintegration of the particles, and the result is a broken pattern that must be repaired or replaced by a new one. As a rule a pattern is not broken by a single blow, but it is the great number of times it is struck. I have found few molders who understand the action of this continued rapping, but when the matter is once explained to them they can generally be made to see its importance, and as a good result exercise more care in their use. Molders should not be allowed to rap patterns with iron hooks; the use of light wooden mallets or hooks with rubber heads will cause a large decrease in the pattern account. The same general rules apply to flasks, follow boards and tools, as it is these seeming small things that play an important part in a year's business.

CUPOLA MANAGEMENT.

It is not my purpose to speak of any special form of cupola, as there are so many, each claiming to be the best, so

shall leave that matter to individual opinion, and devote my remarks in a general way as to how a cupola should be run to secure the best results.

It is pre-eminently the duty of a manager to understand how to run a cupola in all its details, so that in case of emergency he would be able to prepare his cupola for a heat by putting in the "bottom," making the blast and lopping hole in the proper manner. If he is able to do this, and I do not mean that it ought to be necessary very often for him to do it, he will find it greatly to his advantage, as to be at the mercy of a "tender" as the writer has been in some instances, is not the pleasantest position possible. On the proper working of the cupola much depends, and he should be able to direct the proper way to do it and see that it is done.

A careful record should be kept of each day's heat, showing just how much iron was melted, with the amount of coke consumed, so that in case anything goes wrong he will have a definite data to work on, and so be able to detect and remedy the difficulty at once. There is nothing so trying as a bad working cupola, hence the necessity of a thorough practical knowledge of the matter. The only correct system of charging a cupola is that of weighing all that goes into it, coke as well as iron, as only by this means can be definitely determined just what is being done in the way of economy in fuel, as every pound of coke consumed more than is necessary to keep the iron of the proper temperature means so much loss; at the same time he should see that the iron is always hot enough, as the loss of castings even to a slight extent from dull iron will more than make up what might be saved by being too economical in the use of coke, aside from the fact that he owes it to the molders, who are piece-workers, to furnish iron hot enough to "run" their work.

There is another matter in connection with cupola management that is often looked upon as a matter of slight importance, and in consequence is the result of considerable loss. I allude to the manner of disposing of the bottom or "dump." It is the custom in some foundries to pay no attention to it, and the whole mass is thrown away, or in others, put into tumblers and ground up when all that is left except the iron is thrown away, which is very extravagant. The coke that is unconsumed should be carefully picked out, as also the iron, and taken back to the "scaffold." Let some of those who have been pursuing this false course try it for a week, weighing the amount of coke each day, and they will be surprised at the saving, and will not be apt to go back to the wasteful system. So far as grinding the cinder or slag is concerned, I believe that if a cupola is properly fluxed and the slag drawn off at the right time, it will be found that the amount of iron saved will not pay for the expense of grinding, as under proper conditions the quantity of iron in the slag will be very small.

YIELD OF CASTINGS.

There are many managers who, when asked as to the percentage of good castings they get, will say they do not know, as no records are kept, or in other instances will give figures so far out of the way that it is very evident that they are talking at random. It should be the constant aim to keep the yield up to the highest point all the time. This can only be done by keeping a daily record of each day's product after deducting all loss by breakage or other causes, so that it will be known absolutely what is being done. There are at times difficulties that foundrymen encounter, such as a change in the iron used, or an inferior quality of coke, making hard or "dull" iron, and consequently a large increase in breakage, as well as an excessive loss by the molder, that the variation in product will often reach 4 or 5 per cent. By the keeping of a daily record, the matter is at once brought to the attention of the manager, and it is to be supposed that steps will be taken to remedy the evil. It is only by keeping such records that the proper means can be observed to keep the foundry up to the highest point in the matter of production, which is an important factor in the cost. The average yield in a stove foundry should not fall below 63 per cent.

CRACKING OF CASTINGS.

This is one of the most troublesome things that a manager encounters in his work, and to know how to prevent it is a matter of the greatest importance. Presuming as a matter of course that iron of the proper kind is used, it is often found that certain castings will crack in cooling. This is sometimes caused by faulty construction, and in such a case must be overcome by gating in such a manner that the casting will, as nearly as possible, cool all at the same time; and unless one understands the law governing the expansion and contraction of iron, mistakes are apt to be made that only tend to aggravate the trouble. If a casting can be made to cool equally there will be no strain at any one point, and as a result the liability to crack is reduced to a minimum. Hence the necessity of being able to detect the cause, as well as to suggest the remedy. It is sometimes thought by unskillful men that the proper way is to strengthen the piece at the point of cracking. That, as a rule, will not do, as the unequal strain still exists, and the casting will crack at the next weakest point.

EXECUTIVE ABILITY.

No matter how well qualified a man may be in the points mentioned, unless he possesses this faculty he cannot hope to succeed as a manager. He must be a judge of men, so that the work can be divided to the best advantage for all; he should know what is a proper amount of work for a man, and to see that it is done. Every man should, as far as possible, have the work given him that he is best able to do, and it should be required of him that he perform it to the best of his ability; at the same time he must see that the men are furnished with the best facilities for doing their work, as to expect good results without these is unreasonable.

In his dealings with the men under his charge he must be just and firm; he must have their respect, and to secure this he must respect them. Very often a word of encouragement spoken at the right time will be of value. There are times that, owing to causes that the molder cannot control, work is lost or unsatisfactory, and a cheerful encouraging word from his foreman will make things seem brighter, and often pave the way for a lasting friendship that is always good between men placed as they are.

He should never make a promise to a man that he is not sure he can fulfil; by this he will be able to retain their confidence which he will find greatly to his advantage; at the same time let it be understood that when he gives an order it must be obeyed. The manager should be sufficiently familiar with machinery as to be able to detect any imperfection in its working, and see that it is kept in proper order, and that it is correctly put up so that it will run to the best advantage with the least expenditure of power.

He must at all times see that proper discipline is enforced, and have the men understand that while in the shop it is their duty to so conduct themselves that the interests of the employer will be served in the highest degree. It is not necessary that any harsh or unjust regulations be enforced, that are galling to their self-respect, but let them understand that the rules for the proper conduct of business are as much for their own benefit as for those who employ them.

The Danger of Using the Hand Hammer in the Testing of Cast Iron Pipes.

BY S. GROVES.

"ALL the pipe over two inches in diameter are subjected to a hydrostatic pressure of 300 lbs. per square inch; *an additional test is made while the pipe is under this pressure, by striking it throughout its length with an iron hammer, this making apparent any flaw or imperfection existing.*"—*From Pipe Founders' Catalogue.*

In February, 1889, the present writer—while engaged with the largest pipe founding concern in the north of England—conducted a series of experiments which conclusively demonstrated the

danger of the universal practice of striking cast iron pipes under pressure, with a hand hammer.

Two socket and spigot pipes 4″ in diameter by 9′—0″ long by $\frac{3}{8}$″ thick—one cast vertically, the other cast at an angle—were subjected in the hydraulic proving press to a hydrostatic pressure of 260 lbs. per square inch, and while under this condition, a wrought iron ball weighing 1½ lbs. was let fall upon a chalk line mark on the body of the pipe, at given points and from varying heights, as indicated by figures 1 and 2:

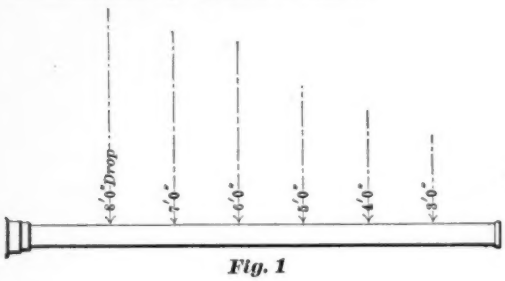


Fig. 1

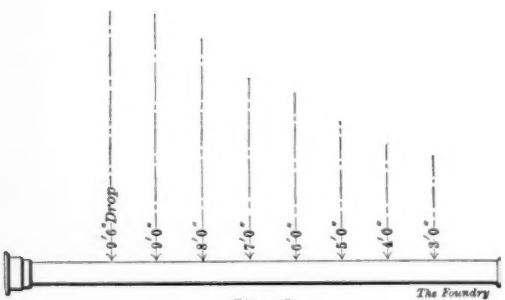


Fig. 2

The pipes are then taken out of the press and broken longitudinally into two parts, when a remarkable phenomenon was revealed. On the inside of each pipe, at the points where the ball had struck dead upon the center line, was a star-shaped fracture, thus:

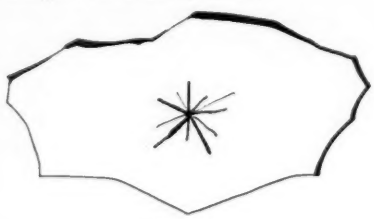


Fig. 4

The fractured half of each pipe was then broken into two parts, and each piece upon which a blow had been struck was carefully broken through the star-shaped fracture. To our further astonishment, we discovered in each section an oxidized fracture penetrating through the inside skin of the pipe into the body metal; and in no case was the depth less than 3-32″, the greatest being 5-32″.

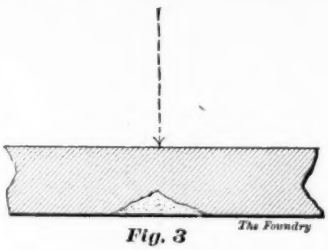


Fig. 3

The following is a table showing the depth of the respective fractures:

PIPE CAST VERTICALLY.

Drop.	Depth of Fracture.
3′ 0″	Slight
4 0	3-32″
5 0	Slight
6 0	Slight
7 0	$\frac{1}{8}$″
8 0	5-32″

PIPE CAST AT AN ANGLE.

Drop.	Depth of Fracture.
3′ 0″	Slight
4 0	Slight
5 0	$\frac{1}{8}$″
6 0	Slight
8 0	5-32″
8 0	3-32″
9 0	Slight
9 6	3-32″

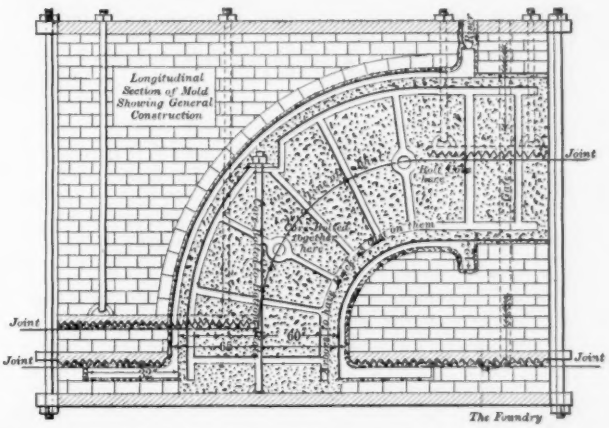
The cases marked "slight," were due to the deflection of the ball, in consequence of not falling dead upon the center line. In every instance where the ball struck true, a serious fracture resulted.

Instead, therefore, of the hammer sounding test being a safeguard, it is actually a danger; worse than a variation in body thickness of 1-16 of an inch, for which many a pipe has been sent to the scrap heap.

A like danger there is to all hollow high-pressure castings, out of which the cores are shaken by terrific blows of the hand hammer—one of the most effective forces known in the mechanical arts.

Other Ways of Doing It.

IT is a hard matter for molders always to look pleasant, as the trade carries with it so many perplexities, which continually manifest themselves in many different ways. While a casting may be made one way and everything run smoothly, by placing the same pattern in a different position, considerable annoyance may be caused. It would sometimes appear as if formen try to increase the difficulties which beset the molder, by insisting upon castings being molded in most fanciful positions, but a good reason can in nearly all cases be cited sustaining the foreman in his mode of procedure.



In the accompanying sketch is shown an odd way of making an elbow pipe, that to some may seem entirely uncalled for. The illustration being self-explaining, no further comment is necessary, as it only appears here as an illustration of the diversity of molding.

Photography and Mechanical Arts.

THE last decade has seen such rapid strides made in the art of photography, its appliances and its practical uses, that we may indeed say this is a wonderful age.

Only a few years in the past, photography was a subject of mystery, except to the few professionals who were in the business. The average man looked upon a camera with awe, and having one's "picture taken" was an important event.

The introduction of the "dry plate" has wrought a revolution and was the entering wedge which burst open the mystery and let in the light of information.

As soon as it became known that a man of average intelligence could take photographs without serving an apprenticeship and without being obliged to carry a whole laboratory into the field, disciples of the art "flocked to the standard," and today there are thousands practicing the art where there was one in the past.

The increasing interest in photography stimulated the manufacture of cameras and other accessories, and invention followed invention, until today cameras are made which seem to be perfection for either the amateur or professional, and the great demand has cheapened the cost of production, until now even the poor man can indulge in the pleasure of making pictures.

Today photography and photographic reproduction have made it possible for the poor to possess fac-similes of the most famous paintings of the world. Beautiful and far-distant scenes can be brought to ones door at a trifling expense, and one need not travel to become acquainted with foreign countries.

Our beautiful and the most wonderful World's Fair the world has ever seen, which is now a thing of the past, has, thanks to photography, been preserved to us in a form that will enable all, even if they were not fortunate enough to have visited it in person, to

visit it now for a trifling sum, and revel in its beauties and wonders.

The camera is being introduced into all large manufacturing establishments, and work in different stages of completion is photographed and prints made and preserved for future reference.

Instead of bulky samples of machinery or manufactured goods, photographs are carried by the commercial traveler and used to sell his wares. Reproductions in half-tones or in finer photogravures are mailed as advertisements. The process being so much cheaper than old line engraving that even small establishments can avail themselves of the great benefits of this method of placing their products before the public.

Foundries, machine shops, engine builders, architects, ship yards, brick manufacturers, stove makers, manufacturers of tinware, tool makers, etc., can all use photography to illustrate their product.

The taking of a photograph is now a simple matter. The dry plate comes ready for use; the one solution developer requires only the addition of water. The prepared paper is easily manipulated, or for ordinary prints, the "blue print" paper (Ferro Prussiate paper), which only requires washing in water, gives the operator a simple method of making a picture of a machine, a casting, or a building.

The literature of photography has also grown, many publications treating on all the different processes having been placed on the market, and several monthly magazines devoted to nothing but photography, are issued. One of the best, if not the best monthly publication for the use of the amateur and beginner in the art, is *The American Amateur Photograyher,* an illustrated magazine edited by Alfred Stieglitz and F. C. Beach—both noted persons in the art and earnest workers—and published by the Outing Company, Ltd., 239 Fifth avenue, New York.

The March and April numbers of the *Amateur Photographer* are excellent specimens of the magazine, and the range of subjects and illustrations is very great.

The illustrations in the March number show excellent work by the photographer, and the reproductions are beautiful specimens of the latest methods. The frontispiece, "Laparotomy," is without doubt a marvelous reproduction and the subject a novel one. "The Milkmaid" and "The Old-fashioned Garden" are excellent figure pictures, and show careful study for artistic effects.

"Winter," by Alfred Stieglitz, is a picture that only the initiated can properly appreciate, but it is cold and dreary enough in its appearance to make one believe it is winter.

The article on "Illusion Photography" and the accompanying illustrations are reproduced from the *Scientific American,* and will cause many amateurs to try their hands at this fascinating amusement.

The April number with its "Near Geneva" and "Wild Weather," show two directly opposite scenes and conditions of nature. One all beauty and serenity, the other wild, turbulent and gloomy. We can almost imagine we can hear the wild shrieking of the gale and the roar of the surf, as it dashes upon the dreary and desolate shore, and almost expect to see the bending figure in the foreground swept away by the fury of the blast.

An excellent flash-light view of two men drilling for a blast underground, and entitled "Mining Life," shows what can be done by this great discovery in photography.

"Chasing Butterflies," a beautiful summer idyl, and "Toil," a picture evidently modeled on Millets "Man with a Hoe," are fine examples of the art. The initial letters throughout the issue are gems of art, and the many interesting and instructive articles serve to make these numbers worthy of a place on any one's library table.

Obnoxious.

Philanthropist — Didn't you enjoy good educational advantages in your youth?

Convict—No, sir.

Philanthropist—Too bad.

Convict—In fact, I just hated them.

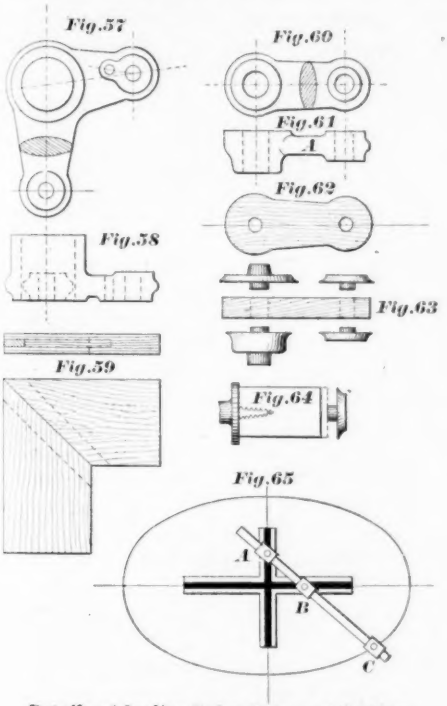
Lessons in Patternmaking for Manual Training Schools.

BY P. S. DINGEY.

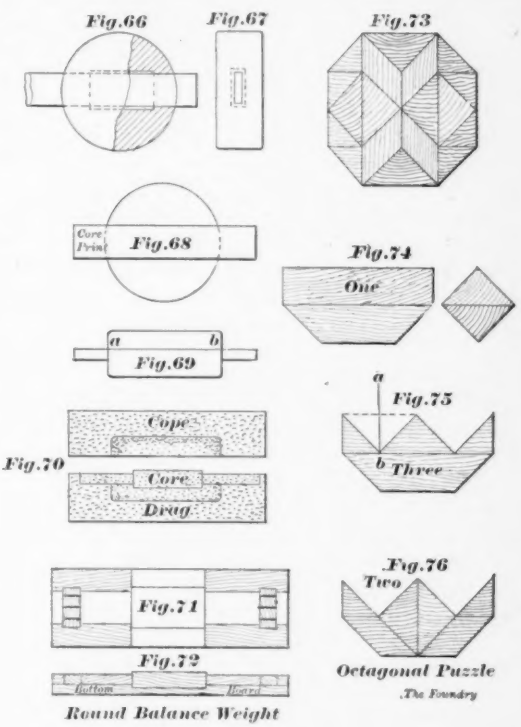
IV.

CORLISS VALVE GEAR.

Figs. 57 and 58 are two views of a hook lever, and Figs. 60 and 61 of an exhaust arm, parts of a Corliss engine. The arms are of an oval section as represented in Figs. 57 and 60. The way of making the pattern for the exhaust arm is shown in Figs. 62, 63 and 64.



Details of Corliss Valve Gear and Laying out an Ellipse



Round Balance Weight

A piece of wood is planed parallel to the thickness of A in Fig. 61, and after the outline of arm is laid out it is carefully sawed out with a narrow hand saw, to the shape in Fig. 62—bore a $\frac{3}{4}$" hole through each center as straight as possible, so that the distance from center to center shall be the same on both sides. This being done, turn the four small bosses shown in Fig. 63 with pins on them, which shall fit tightly into the holes just bored, and as it is intended to cast a hole in the large end of casting so that the metal may not be drawn away from that part, by the lighter portion cooling first, turn two core prints on the larger bosses, as shown.

To turn these bosses, first saw out a rough piece from any odd scrap off a thick plank, and large enough in diameter to turn the largest boss, then screw it on the screw chuck of the lathe, as seen in Fig. 64. In this way the bosses may be turned and cut off with a narrow cutting-off chisel, the cutting off being represented by dotted lines. Do not attempt to get out the piece for turning the bosses end ways of the plank, as the fillets would certainly break. The bosses should now be glued in place on each side of the arm, taking care to locate them so that the grain of wood in the bosses and arm run in the same direction. Now work the arm off around the edges and between the bosses, as shown in drawing, and do not reckon on too much finishing with the sand paper,

but whittle all the corners off nicely first, for it is impossible to make up with any amount of sand-papering what ought to be accomplished with tools. Most beginners are too apt to start sand-papering their work before they have properly shaped it with tools.

The pattern for hook lever in Figs. 57 and 58, is made after the same manner as exhaust arm, except that the plate forming the two arms is made in two pieces fastened together with a tongue, as seen in Fig. 59—the bosses will also serve to hold the joint together when glued on each side.

LAYING OUT AN ELLIPSE.

It will not be out of place to introduce here one of the many graphical methods of laying out an ellipse. Fig. 65 shows one of the simplest and best methods in use.

A cross with a groove in it is fastened temporarily to the board or paper on which the ellipse is to be marked—three sliding blocks are fitted on a rod in much the same manner as trammel heads—in the two blocks marked A and B are pins which fit and slide into the groove of cross; block C is provided with a short piece of lead pencil. When these three blocks are located on the rod at the desired distances, the ellipse can be laid out by moving the rod in such a way that the pin in A will slide in the groove of the minor axis, and B in the major, while C will mark the outline of ellipse.

ROUND BALANCE WEIGHT.

Two views of a round balance weight on the end of a lever are shown in Figs. 66 and 67. Fig 66 is represented in part section, with the chambered hole for the lever. The pattern is made in two parts doweled together with two dowel pins. It is parted on *a b*, Fig. 69, in line with the side of hole; a flat piece of wood the size of lever is set in flush with the joint in the large part of pattern and extending over the sides for core prints, Fig. 68. The object for parting the pattern at *a b* in Fig. 69 will appear clear when referring to the section of mold in Fig. 70. When the mold is parted, the smaller part of the pattern comes up with the cope and is afterward drawn out in the ordinary manner. By this way the operation of setting the core is made easy, as building over the core is dispensed with. The hole in the weight is chambered to give clearance in case the lever or core should not be perfectly straight.

For the core box, a frame is made and fastened to a bottom board, similar to that in Figs. 71 and 72. The three small grooves in the cross pieces at each end are cut half way through, to allow the coremaker to lay in three pieces of wire in the core while making; those on either side of the center are left in the core to strengthen it, while the center one is drawn out after the core is made, leaving a small hole through the core for the gas or "vent" to escape.

OCTAGONAL PUZZLE.

The octagonal puzzle, though very simple, is one of the best exercises whereby the accuracy of the student's work may be tested.

It consists of six short square pieces of wood fitted together diagonally in such a way that each piece locks into the other, making when together a ball like that shown in Fig. 73. Unless these pieces are planed exactly square, and each notch cut to fit over them perfectly, the chances are that the pieces will not go together, or if they do, will not hold together because of being to loose; but if care be taken in preparing the short square pieces and cutting away the notches, they will fit together all right, and it will puzzle a good many which is the key or plain piece when the six pieces are together in a ball.

First, plane up a stick square, and long enough to make the six or more pieces, then mark off each piece allowing space enough between each for sawing off. Do not step into the mistake of marking the notches at an angle of 45°, as any one is very apt to do, but strike a center line, *ab*, then from these two points draw lines to point *b*. After obtaining the angle in this way set a bevel to the angle obtained and use it to mark off all the notches.

Notice there are three pieces with two notches in each like that in Fig. 75, two

with three like that in Fig. 76, and one key in Fig. 74. Rather than saw off the six pieces before cutting the notches, it will be more convenient to cut all the notches before sawing off any of the pieces.

In fitting these six pieces together, the key is the last to go in place, and the two in Fig. 76 always go opposite to each other. With these suggestions the rest of the construction should be accomplished without aid.

Improved Universal Wood Trimmer.

IN the accompanying illustration may be seen front and rear view of an improved No. 2 Universal Trimmer and some of the work done by this remarkable tool. We give herewith such a description as will be interesting to our readers. From what we have seen of actual work done on the machine, we know it is accurately adjusted and a very remarkable time-saving tool.

The standard giving solid support for the machine is a hollow casting with broad base entirely out of the way. Two results are thus obtained by thus mounting the machine: First, it is made to swivel on the standards to accommodate two or more workmen and to secure instantly the best light on the work; second, machine is not left in the workman's way on the bench.

The greater power in this machine is secured by means of a convenient adjustable handle engaging with a cut gear of small diameter. It is no longer necessary to walk around the machine when operating the lever, as by this device the operator remains in one position to complete full stroke of the knife or to operate the knife nearest to or furthest from him. The adjustment of the handle is made instantly by a slight lateral motion and it is so counterbalanced that it remains at whatever point released by the hand.

The cut gear and rack, together with the lower way for conducting the knives, are so covered as to entirely prevent dust and chips from lodging thereon. The upper knife way is the simple tongue and groove principal. All the bearing surfaces are perfectly fitted, and being very long the wear is reduced to a minimum and the machine enabled to resist great strain.

The side gauges are faced with steel, the points being adjustable by means of blind set screws, so as to regulate the distance between them and the knives and this adjustment is very exact since the best results in fine work depends largely on the close adjustment at this point.

The side gauges can be instantly set to cut any angle from 30° to 135°, inclusive. Special attention is called to this remarkable range of the gauge, this being the first machine to pass from 90° to 135°, thus enabling the operator to cut what is termed the "back mitre," corresponding to the inside 45° mitre, and quite as useful and necessary.

These side gauges are held in position by means of steel shoes, accurately fitted and traveling through milled grooves or arcs of circles in both bed and gauge. By this device the point of the gauge maintains its true center at whatever angle set.

The principal angles are inscribed on the bed of the machine. Both edges of the bed are planed parallel and bevel square is used in setting gauges to angles not inscribed.

The upper knife-way does not project over the bed of the machine, but is in line with the cutting edge of the knives, and instead of hindering the trimming of work extending higher than this way it may be utilized as a gauge when cutting the lower portions of work fastened together.

The detachable gauge stop may be fastened by thumb screw to either the side gauges or to the bed of the machine, and is of use in cutting pieces of same length or size, or in cutting the segments of circles.

Much has been added to the weight of the tool, as the demand from representative firms has been for a tool to withstand all possible strain and to do most accurate work, and by due regard for rigidity and proportion it has been possible to meet these requirements in this machine, whose graceful outlines are at once recognized.

The knives are made of the best tool steel, are ground on both sides, absolutely perfect, are very thich and are interchangeable on different machines.

In the illustration may be seen some of the work done by the tool, such as surfacing with or across the grain, cutting bevels, mitres, drafts, right angles, segments, outsides of circles, and angles both within or without the square or angle of 90°. The high grade of materials entering into the construction of the tool have done much to sender it one of the most useful and popular tools of the day. The leading manufacturers of this country use and indorse the machine, and the large sales from the branch house at No. 11 Old Hall street, Liverpool, England, attest its popularity abroad. Information cheerfully furnished by American Machinery Co., 174 Griswold street, Detroit, Mich.

TEH FOUNDRY is the only paper in the world published exclusively in the interest of the foundry. Only $1 a year.

THE FOUNDRY

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THE FOUNDRY is issued promptly on the tenth of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

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Low Wages Not a Blessing.

WE have on one or two occasions criticised the dullness and uniformity of the various pig iron market reports published, and have expressed the belief that while ostensibly issued with a laudable purpose, yet their effect has been to help in the demoralization of the market—a result that benefits no one.

One of these, however, that came recently to our attention is worthy of especial notice as being considerable of an exception to the forgoing rule and because of its origin the original statements contained therein are deserving of especial mention. Rogers, Brown & Company, the extensive pig iron dealers, who from their position as the largest handlers of that material in America, having offices in many of our large cities and over a dozen representatives continually on the road, in their report of April 14 come out as follows:

"The struggles of labor to secure some improvement of wages excite no little sympathy from the business world in general, for it is recognized that no one is benefited by the steady and remorseless shrinkage of wages. Certainly the manufacturer is not, for every reduction of cost is given to the consumer, who in his turn has his purchasing ability curtailed by the greatly restricted earning power of the people."

What clearer or more pointed statement of the case could anyone wish for? Judging from its tenor it would seem to be to the interest of every manufacturer or employer to maintain wages at the highest possible notch, consistent with safety, and their steady demoralization is an evil that they point out only reacts against those whom it is supposed to benefit.

THE FOUNDRY congratulates this firm on the independent stand they take on a question that is fraught with so much importance to our national welfare, that it is receiving the attention of leading thinkers and writers in all parts of the world. Unquestionably one reason for the prosperity America has enjoyed during the past years has been the high wages paid its workmen, and anything that tends to lower that standard, injures our national progress all along the line.

Foundry Mixtures.

THE educational campaign that is being conducted to give foundrymen the benefit of a wider knowledge of pig iron, is likely to be productive of much good results. The Foundrymen's Associations are calling on their most

intelligent and practical members to give the public the benefit of their wide experience. There has been quite a decided difference in views expressed by them, but many points in common have been discovered. It is likely that it will be decided that for the smaller works at any rate, some simple test will be adopted that will give satisfactory results without the necessity of calling in the chemist except at rare intervals. For larger works it may be found best to combine both methods. We notice that the firm of Rogers, Brown & Co., who are prominent sellers of pig iron, have undertaken to place in the office of each iron foundry in the United States a copy of the pamphlet on "Foundry Mixtures," written by W. J. Keep, of Detroit. It is the paper that was read before the Foundrymen's Association at the meeting held at the Manufacturers' Club in Philadelphia, on Wednesday, April 4. The paper has attracted much attention and it is now published in a very convenient shape for reference.

Sick.

THE country is sick—sick all over. It would seem as if every function of its internal system had got out of repair. It appears to be troubled at one and the same time with a rheumatic attack that makes every motion difficult and painful. It seems to be suffering with a consumption that has caused a rapid wasting away of all its vitality. Its circulation is out of order, its accustomed vigor and energy have vanished, and while the present illness has lasted a little over a year, no great improvement is perceptible. True, conditions have changed somewhat, and the patient just now appears to need a different treatment than was needed at this time last year, but the main thing necessary is some powerful medicine that will force a movement of its industrial machinery.

But the doctors in the case—what of them? Where are they? What are they doing? And what are their predictions as to the patient's recovery?

Well, the doctors of all imaginable schools, adherents to all manners of systems (and lack of systems) have been for eight months past holding a congress of its wise men discussing the patient's case, its causes and methods of cure, and up to date have done nothing but quarrel over the treatment necessary. It would seem to be divided into two divisions with various smaller ones on the side, all of whom diagnose the trouble in radically opposite ways and appear more bent on exploring their various idiosyncrasies than giving the patient a little careful nursing and simple remedies that with its naturally vigorous constitution would enable it to soon regain its feet. It is apparently of far more concern to them that the other fellow and his previous treatment of this same patient or the latter's fear of future treatment by another doctor, should be made the scapegoat for the present serious situation, than that he should be cured.

If one set of doctors are not going to have the job, they seem to have a fiendish resolve to prevent the other fellow from getting it, and in the meantime untold agony, suffering and misery are the results. The story of the Kilkenny cats is being illustrated over again without the comfort that there is any likelihood that these imitators of such a noble example are likely to succeed in destroying each other. They are too careful of their good clothes and good looks and while faring sumptuously every day at the expense of those they misrepresent, they forget they have it in their power to administer the nourishment that would be such a boon to thousands.

Stove Manufacturers' Convention.

THE recent annual gathering of the stove manufacturers of the country in Chicago passed off smoothly and quietly. The number of delegates present seemed to be up to expectations, and considering the financial and industrial condition of the country and the fact that the business of all seemed to be suffering, it would be hard to find a more substantial looking or happier gathering of business men than those who made the Auditorium Hotel their headquarters during the first week of this month.

As the association exercises a strict censorship over the matter of giving out news of its proceedings for publication, it is not possible for us at this time to give an extensive report of what was done, but the two papers published elsewhere were, together with the discussions attendent thereto, among its prominent features.

The first paper, by Mr. Jos. Leon Gobeille, founder and head of the Gobeille Pattern Works, Cleveland, O., was startling in its originality, and while it is more than likely that Mr. Gobeille's studies and artistic temperament have placed him so far in advance of the ordinary stove manufacturer on the subject of

"Design" that the latter is not apt to fully appreciate the suggestions contained in his paper at their true worth, yet it must be conceded that Mr. Gobeille has not only given them something to think about, but has demonstrated that an intimate relation may exist between "form" and "sound," and harmony being essential in all things where either are in question, it is possible that one is as necessary as the other, and may be used to advantage in productions where the principles of design are utilized to form either a graceful, attractive pattern or a grand march.

Mr. Cribben's paper, like the man himself was intensely practical, and is, we think, a valuable production that should be in the hands of every molder and apprentice in the land.

He deals with the evils besetting the molder of today, in a way that only one who understands the whole business from the start to finish could be expected to do, and the suggestions contained therein, coming from such an eminent member of the craft as Henry Cribben, are worthy of the most earnest consideration.

The Scrap Heap.

"The applause of listening senates to command,
The threats of pain and ruin to dispise,
To scatter plenty o'er a smiling land
And read their history in a nation's eyes
Their lot forbade, nor circumscribed alone
Their growing virtues, but their crimes confined.
Forbade to wade in slaughter to a throne
And shut the gates of mercy on mankind."

* * *

So wrote the poet, Gray, long ago, and one cannot help feeling the dignity, purity and nobility of the man when reading these inspiring lines, known now as they probably will be for years to come as Gray's Elegy, and which are said to compose one of, if not actually the most beautiful poems, all things considered, in the English language.

* * *

They are suggested to us by some of the labor disturbances of the past few weeks, as they are reported to us in the daily papers and by information gathered by a representative of this paper from interviews with interested parties, principally manufacturers.

We refer more particularly to the troubles now existing in the coke district as being probably of more interest to foundrymen at this time.

* * *

The Connellsville coke region, from which practically all of the foundry coke used in this country comes, contains according to the latest reports 17,513 ovens with an estimated weekly capacity of 105,796 tons of coke. Of this number over 9,140 ovens belong directly to the H. C. Frick Coke Co., while it is said a large percentage of the balance are controlled directly by that company.

The McClure Coke Co., W. J. Rainey, and Brown & Cochrane control the balance of independent ovens possessing any large capacity.

* * *

It will thus be seen that the Frick Company practically controls the business. If they choose to force a reduction in wages, other operators must do likewise, and the same is true regarding the price, as if they choose to reduce that, likewise it must be met. To such an extent is this true that it has become a sort of second nature or unwritten law among all other producers to simply follow the lead of their large competitor, any other policy being suicidal, as any business man can readily see that opposition to the "monopoly," as it is called, would mean ruin to the concern attempting it.

* * *

It appears that in February, 1891, what was known as the "Frick Scale" went into effect, the agreement being for three years, the price of coke being in the vicinity of $2.75 per ton. This price was gradually lowered, until September, 1893, it was selling at $1.90; October, $1.65; December another cut to $1.45, and in January a further reduction to $1.15, all these, it is claimed, having been made by the Frick interest.

* * *

Now follows what is really the most interesting part of this little story. It is claimed by other operators that this unnecessary reduction in the price of coke was made for the twofold purpose of forcing certain other operators to dispose of their plants and compelling the army of employees to accept proportionate reductions in wages, and that both objects being attained as far as possible the price of coke may be expected to advance.

Benjamin Franklin is said to have been the author of the statement that "God helps those who help themselves," but it is doubtful whether that assistance can be relied upon when such methods are employed by any man or set of men in order to help themselves to the property of other people, although the man who erected the first lightning conductor in the shape of a kite would seem to have good backing, as that eminent man, Napoleon the Great, stated that in his experience he had always found "Providence on the side of the heaviest artillery," and he was the greatest artilleryman the world has ever known.

* * *

An interesting suggestion has been made by a leading coke operator that furnishes much food for thought at this time. It is well known of course that the Frick coke interests were consolidated a few years ago with the Carnegie iron and steel interests and they are now practically one, the steel end of the business bearing nearly the same relation to the other steel concerns in the country as the coke end does to its competitors.

* * *

Supposing the scale *settled* and the matter of competition also *arranged*, what is to prevent the Frick interest advancing the price of coke to $2 or $3 per ton? This is a question for the thousands of steel and iron plants in the country to answer, but one that more particularly affects the steel interests, as with the Carnegie mills getting coke at say $1 a ton and the others paying the advanced price and using thousands and thousands of tons, competition would be rendered impossible and one concern would likewise control if not actually own the steel business of the continent.

* * *

This same enterprising, ambitious octopus is already *interested* in various furnaces making different brands of pig iron and but little stretch of the imagination is necessary to see how easy it would be to exert the same quiet agency in that direction with similar results.

* * *

THE FOUNDRY admires enterprise at all times, but it is conceded by our best thinkers that the concentration into few hands of the wealth resources or manufacturing establishments engaged in any special line is something greatly to be deplored and an evil that legislative enactments cannot remedy, and we have only hinted here at what is possible in one or two cases alone.

It seems to us that foundrymen all over this continent should think twice before placing orders for coke and endeavor as far as possible to only patronize those who are interested in developing and increasing this country's industries rather than curtailing them.

Gone Into Blast Again.

THE historic Round Mountain Furnace has passed into the possession of a new company, called the Round Mountain Furnace Co., with headquarters at Chattanooga. Mr. L. S. Colyar, who has been connected with iron interests in the South for many years, is president. The furnace is located at Round Mountain, Ala., and during the war it was run to make iron for cannon for the Confederate government. After the war it was idle for many years, but was put into operation and gained a reputation for use in chilled rolls and similar work requiring great strength. It has been out of blast for about three years, but was started early in April, and it is claimed that the present make of iron is superior in color and strength to any ever produced. It is cold blast and the product is only 14 tons per day, but it is expected that this will be increased to 16 or 17 tons. The owners claim that it is the best iron made in the United States. This is quite comprehensive, but they say that tests will prove it. The sole selling agency has been placed in the hands of Rogers, Brown & Co. and their branch houses. The iron is held at a figure above the ordinary car wheel brands, but no higher than the best cold blast charcoal.

Meeting of the Stockholders of the Jos. Dixon Crucible Co.

AS an evidence that times are not so deplorable as they are said to be, was the satisfactory meeting of the stockholders of the Joseph Dixon Crucible Company, held at their fine offices in Jersey City, N. J., April 16. Out of 7,345 shares, 7,215 votes were cast for the same board of managers that has conducted the affairs of the company through its years of prosperity. The vote was the largest ever cast and it was a decided compliment to the members of the board, as were also the remarks of some of the largest stockholders. The board consists of E. F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Joseph D. Bedle, Jerome D. Gillett.

In the organization of the board Mr. E. F. C. Young was elected president, John A. Walker vice president and treasurer, and George E. Long, secretary.

The Dixon Company was founded by Joseph Dixon in 1827, and organized as a stock company in 1868.

Its manufactures are graphite products of all kinds, consisting of plumbago crucibles for melting gold, silver, brass, etc., blacklead retorts, stove polish, graphite for lubricating, electrotypers' graphite, graphite lead pencils, graphite paint, and graphite prepared in hundreds of ways for as many different uses.

Graphite is one of the principle forms of carbon. It is not affected by heat or cold, acids or alkalies, and is therefore one of the most useful materials known to modern industry when rightly prepared.

MR. EDITOR:

I see in the March number of THE FOUNDRY that J. I. Glover, of Tabrin, N. C., recommends the use of resin for making cores. I think if he would try a little builders' cement in the place of resin, he would like it much better. He would certainly get rid of that disagreeable smell of resin in baking.

Cores that are made with a little cement will bear a great deal more handling and not eat as the cement makes a crust on the outside.

I have known cement cores to lie in the molds more than a week without softening or cracking. T. G. L.

Middletown, Conn.

Toronto, Ont., Notes.

(*Written for* THE FOUNDRY)

Business here is very dull at present and prospects not very promising. In the jobbing line it seems that the jobs that come in today must be got out today if possible.

The Moffat Bros. Stove Foundry started with about eight men on the 17th, at Weston.

The Furnace Co. started up on the 15th with one man.

The Bertram Engine Works have an order for a one thousand h. p. engine for the Street Railway Co., but business with them seems very uncertain.

The Niagara Street Foundry started this week with six men in a specialty of soil pipes and soil pipe fittings.

John Inglis & Sons had their foundry on fire on April 11; damage about $1,000.

Navigation is opening up, which should have a tendency to stir trade up a little; at least we hope so. T. A. H.

New York and Vicinity.

(*From Our Own Correspondent.*)

THE condition of trade has undergone no material change during the past month. Coxeyism, low prices, and uncertainty regarding employees making an effort to get back their old wages, are the principal topics for discussion. There has been sufficient molders and foundry workers out of employment during the past winter and at the present time to constitute an iron brigade of considerable dimensions, but their disposition is to stay at home and take advantage of any opportunity that may be presented them to earn something for the support of themselves and their families, witholding their petition to Congress until the opportunity is presented to drop it in the ballot box. It has not been decided whether prices have reached low water mark or not. What the employees will do in regard to their wages will depend largely upon the condition of the market they have to sell their labor in during the coming months. Strikes have been in progress at the A.A. Griffing Radiator Works, Jersey City, N. J., and Cassidy & Adler's, plumbers' supply manufacturers, the employees in all departments are involved at both places. Difference of opinion about wages seems to be the principal cause of the trouble, although it is stated that the introduction of Polish workmen at the A. A. Griffing works precipitated matters there.

The following changes have taken place since last month's report was submitted:

Chas. O. Brown, civil engineer and contractor for steel and iron structural and architectural work, No. 61 Broadway, New York, has secured and put in operation the plant formerly owned by Francis S. Haas, at Bushwick avenue and Scholes street, Brooklyn. The machine and finishing shop will be extended, new and improved machinery will be added, insuring capacity for the prompt and complete execution of large contracts. Furnishing the iron work for the Manhattan Life Insurance Building and Fifth Avenue Theatre, New York, are among the past achievements of Mr. Brown. His works were formerly located at Patterson, New Jersey.

The statement appearing in the April issue of THE FOUNDRY concerning the Puritan Iron Foundry was erroneous, as it has been secured by J. Barrody, who will conduct it hereafter.

The Henry R. Worthington Pump Co. are removing their brass foundry from South Brooklyn to Elizabeth, N. J., where their iron foundry plant is located. The space occupied by the brass foundry and yard at South Brooklyn, will be used for an extension of the machine shop.

Pittsburg and Vicinity.

The Trade Outlook.

(*Special to* THE FOUNDRY.)

FOR a while it seemed that a revival had certainly taken place in the general iron and steel market, more inquiries were coming in, and it may be said there were a few more orders placed during the month of April, than the preceding months of 1894. But there are other founders who differ greatly and say that business has not materially improved any. Orders are not beginning to come in at an alarming rate, nor do they expect them for at least another month, when the spring foundry trade is expected to begin in earnest. To sum it all up, the foundry business may be said to be at a very low ebb, numerous foundries are closed down, while while others are operating, but not to any degree of satisfaction or profit. One large founder in Pittsburg said that not a dollar's worth of business is being done, the only thing visible about his place was the dumping of a cart-load of coal, and this was done for fear that a job might come in.

Reports in the daily press, especially the democratic sheets, would try to make one believe that when a firm gets an order that is wanted right away, and the plant is run day and night to get it off, that the place is being operated double turn with a full force of men, while the true state of things is that the order is only large enough to run the plant about two days, and then comes the shut-down which they fail to report. Reports of this kind are thick in and around Pittsburg, and upon investigation it is found that the plants are not running as full as they were during the month of January, 1894. Then the strike of the coal miners is a drawback to founders, and it is a hard matter to say when the end will come, as both sides seem determined to hold out.

Remarkable as it may seem, it is a fact that there are a large number of plants of all kinds being erected throughout the country. New foundries are plentiful and they are of large size. Operators are taking advantage of the low price of structural material and are making additions at what may seem a good time.

Some few sales of foundry irons are being made at the prices quoted in these columns last month, and which may be quoted again:

No. 1 Foundry,		$11.25@11.50 cash.
2	"	10.50@10.75
1 Charcoal f'dry,		17.50@18.00
2	" "	17.00@17.50

The foundry and forging plant of the Baker Forge Co., at Ellwood City, Pa., is almost completed and will soon be ready for occupancy. Nearly fifty men will be given employment here.

Sterritt & Thomas are still running with a reduced force on a number of orders.

The Fischer Foundry and Machine Co., of the South Side, has received several orders during the past month, which gives employment to a portion of the working force.

The new foundry of the Edgar Thompson Steel Works, at Braddock, was put in operation during the past month, giving employment to about 300 men.

More orders have been received by the Pittsburg Steel Casting Co., Ltd., during the month of April than for any of the previous months of the present year. Orders now on hand are sufficient to give work to nearly the entire force of men.

The Totten & Hogg Iron and Steel Foundry Co. has the contract to furnish the entire plant of the Emlyn Steel and Tin Plate Co., of Summitville, Ind., and three 24" hot mills for the Cumberland (Md.) Steel and Tin Plate Co., while other orders on hand keep the plant running full.

The Lewis Foundry and Machine Co., Ltd., of the South Side, has been dissolved by mutual consent. The business will be carried on by the Lewis Foundry and Machine Co., a corporation organized under the laws of Pennsylvania, which has succeeded to its business and good will.

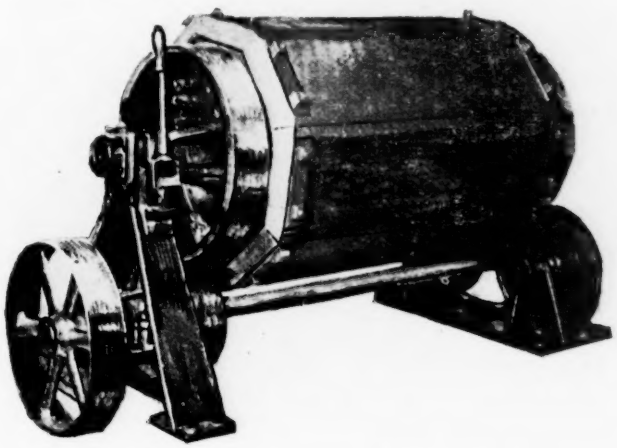
The recently incorporated Lincoln Foundry and Machine Co., with Otis H. Childs and others at the head, has commenced the erection of a plant which will occupy a space of 140x350 feet and which will be located admira-

bly for shipping. The foundry shop will be 120x244 feet and the machine shop 96x100 feet, which together with the offices and pattern shop will occupy the whole space. The buildings are being erected by the Pittsburg Bridge Co., and will contain about 400 tons of structural work.

When the new plant of the Westinghouse Electric and Manufacturing Co., at Brinton, is completed it will be one of the finest and best equipped plants in the world. The plant has been so arranged as to have the departments separate and under the control of different experienced men of wide reputation. All the shops will be well ventilated and will be supplied with abundant electric light, but the most of the power will be used for the transportion and handling of material. Electric locomotives will be run around the outside of the plant, bringing the raw material from the tracks of the P. R. R. and transferring it to the different departments. In the machine shop there will be 12 electric cranes, in the foundry 6 and in the wareroom 6. All will be of a heavy type and of the latest design.

A New Friction Tumbler.

THE new friction tumbler here shown has recently been placed on the market by the Detroit Foundry Equipment Co., Detroit, Mich., who manufacture it under the patents of Charles A. Bauer. A decided saving in power is claimed for it, as well as many conveniences and improvements in the way of exhaust attachments and operating devices.



Each end of the barrel is provided with a turned friction ring, one head resting on idler rollers, while the other head revolves on a paper friction driving pinion which is attached to the main driving shaft, the weight of the barrel furnishing the best possible contact between the driving friction and the barrel. The rotation of the barrel is stopped and started by an ingenious eccentric and wedge device operated by a hand lever, enabling the barrel to be thrown in and out of gear instantly without the use of tight and loose pulleys, shifting belts or clutches.

A number of tumblers may be operated from one shaft and any of them stopped without interfering with the others. One head of the barrel being free of a trunion enables an exhaust hood to be easily attached. The tumbler is made either with or without exhaust attachment, and with either wood steel lined staves or cast iron staves, as may be preferred. It is at paesent manufactured in three sizes, the diameters of the barrels being 20″, 24″, and 28″, standard length of barrel varying from 30″ to 48″, as desired. Special sizes are made to order.

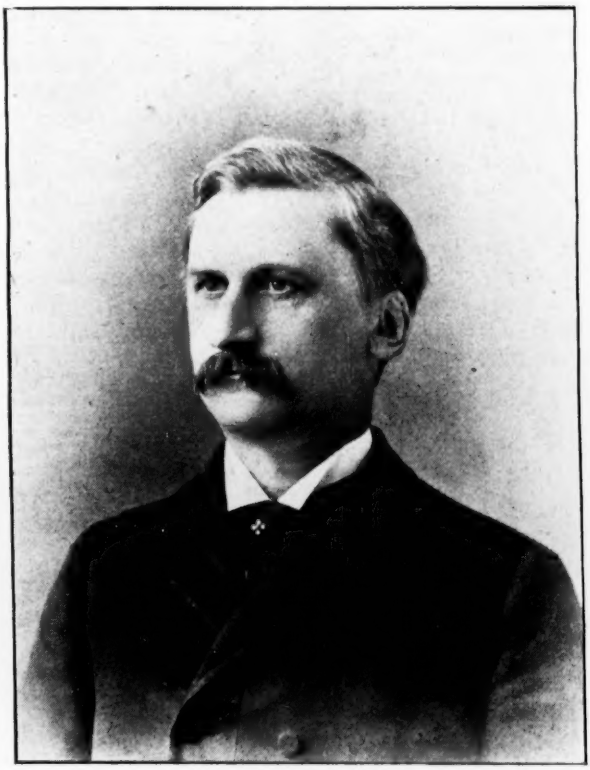
The Detroit Foundry Equipment Co., who manufacture this tumbler, as well as many other improved foundry labor saving devices, report that their new works at Harvey, Ill., will be completed about June 1, after which date their name will be changed to the Whiting Foundry Equipment Co., office, 225 Dearborn street, Chicago; Works, Harvey, Cook County, Ill.

D. M. Thomas.

EVERY foundryman in America knows of the National Stove Manufacturers' Association, and we believe that they are equally as well informed when it comes to the secretary of that large and powerful organization.

Mr. Thomas, to whom is due the honor very largely of the success of this as well as the Stove Founders National Defense Association, was born in Wales, in 1840, coming to America 27 years later. From the start he has been identified with the stove industry, as his first occupation was as a bookkeeper with Farrell, Woodworth & Jones, hollow ware founders, of Troy, N. Y. In February, 1868, in conjunction with Mr. Louis Potter, of Potter & Paris, stove manufacturers, of Troy, he founded the Troy Galvinizing Company. Mr. Potter, later on, disposed of his interest to the firms of Hicks & Wolfe and Sheldon & Green, then two of the prominent stove manufacturing concerns of Troy, and the business continued as long as galvanized reservoirs for stoves were used.

In 1871 Mr. Thomas assumed the management of the Hicks & Wolfe foundry, on Green Island, N. Y., in conjunction with the late G. W. Gardner. In 1875 he, jointly with others, went into the hollow-ware manufacturing business at Medina, O., erecting a foundry building, etc., but owing to lack of capital it was not entirely successful. Late in the same year at the invitation of the late W. H. Tefft, president of the Detroit Stove works, he came to Detroit, and founded the Detroit Iron and Brass Manufacturing Company, a corporation of which he became secretary, managing



D. M. THOMAS.

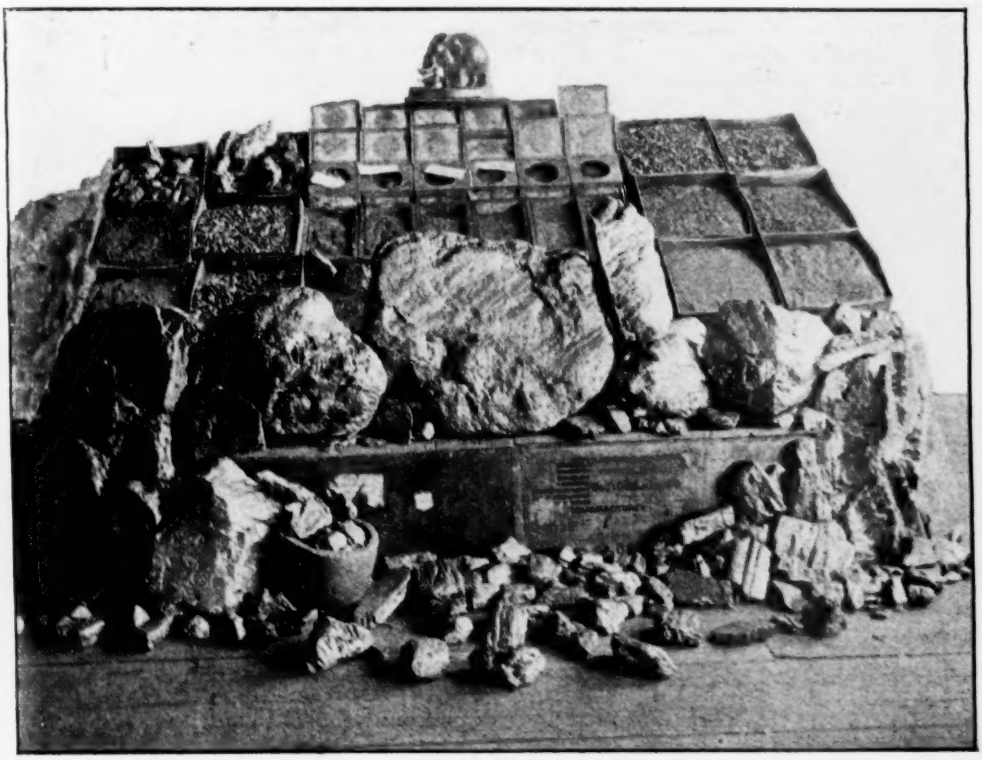
their business at Detroit and Elmira, N. Y., for twelve years, and until the surrender of their charter in 1887. In May, 1886, the Stove Founders' National Defense Association was formed and Mr. Thomas, having been prominent in its organization, was elected secretary, a position he still holds.

In July, 1886, he was appointed as the first permanent secretary of the National Association of Stove Manufacturers, and has so remained ever since, except during the year 1890, when he took the management of the Keeley Stove Co., at Columbia, Pa.

He still retained his interest in the association, however, which its members showed their appreciation of by electing him president for that year.

Mr. Thomas is known as an energetic and painstaking official and no greater compliment can be paid him than the one which the members of both associations have every year conferred upon him by electing him to the important positions he so ably fills in connection with them both.

Of an exceedingly affable and approachable disposition, it is easy to understand the hold he has upon the esteem of all with whom he is brought into contact, and his close attention to the important interests intrusted to his care could have no other result than to win him friends everywhere.



Ceylon Plumbago Exhibit at the Fair.

THE accompanying illustration gives the reader but a poor view of the Ceylon exhibit shown at the World's Fair in Chicago last year, and as it now appears set up in the office of the Springfield Facing Co., Springfield, Mass. Readers of this paper will remember that we referred at that time to the enterprise shown by L. S. Brown, proprietor of this concern, in securing this wonderfully instructive and valuable dis-

play in the face of considerable competition.

The little elephant shown on top is a wonderful piece of carving cut from the solid graphite and is 11 inches long and 8½ inches high. The various boxes shown in the exhibit contain samples of the various grades of plumbago as imported, some of it being exceedingly fine.

The largest piece shown weighs over 300 pounds, is pure plumbago just as it comes from the mine, and is said to be the largest piece in this country. Mr. Brown ought, with such a display before him all the time, to succeed in turning out a first-class grade of facings.

How to Produce Good Workmen.

BY HENRY CRIBBEN.

MR. PRESIDENT: In accord with your request, I have hastily prepared a paper on "The Education and Production of Efficient Workmen."

The limited time I have had to devote to this subject prevents my going thoroughly into its salient points, but I will try to outline as best I can how in my judgment we can secure good and efficient workmen.

Let us first define what in our judgment constitutes a good and efficient molder. He should be temperate, industrious, and work six days in each week, sickness or other unavoidable accidents excepted. He should be competent to perform the work assigned to him in a neat and workmanlike manner, and fully qualified at all times to make the necessary changes required of him that the business may demand. His work at all times should be made to strain weight, unless furnished dull iron by his employer, and oftentimes at less than strain weight, so that when the work is mounted into the stove, range or furnace, the joints will be as perfect as the joints of the well-fitted iron patterns from which he made his castings. He should see that his patterns are kept clean and free from rust, to enable him at all times to make work of a quality that when finished shall nearly equal the pattern itself.

He should every day acquire some additional knowledge of his business, which is not only a trade, but an art that is at times mysterious and difficult to comprehend. He should apply himself whenever the opportunity affords, to learning some part or portion of foundry practice, such as the best methods of lining the cupola, melting iron, and properly mixing same after being melted in the cupola before it is allowed to run into the hand ladles. He should make a study of foundry machinery, including the blower, a proper pressure required; should ascertain the best qualities of molding sand for making the different kinds of castings; should be kind in disposition, always treating his associates and employer with respect; should be honest, truthful and reliable, thus securing the respect and esteem of all with whom he comes in contact, and should constantly try to qualify himself to fill the position of foreman or superintendent, as employers will generally make their selection from among their employees, if they find among them those that are qualified to fill positions of trust. Such men in my opinion constitute the good and efficient workmen; but this class is not numerous, and it has been the common remark of stove manufacturers when annually assembled at their meetings—"How small the number of efficient molders who have a thorough knowledge of foundry practice with the other necessary qualifications to make foremen or superintendents! There is at this time a far less proportion of good and efficient workmen than there was thirty years ago." The only reason that can be assigned for this is, that the average molder has concluded in his own mind that when he learns the trade of iron molding, he is destined to be a hewer of wood and a drawer of water for the balance of his natural life, and he has no ambition to perfect himself in his business, nor to improve his condition, when the opportunity offers.

There are at the present time three classes of workmen:

*A paper read at the twenty-third annual meeting of the National Association of Stove Manufacturers, at Chicago, Ill., May 3.

First, the traveling journeyman or "hobo," who goes through the country from foundry to foundry remaining a sufficient length of time to earn enough to purchase some needed supplies and pay his board, and money sufficient to keep him until he reaches his next stopping place. He is, as a rule, never satisfied with the prices paid for his work, although efficient workmen make good wages on the same work at the same price; dissatisfied with himself and his associates, he creates as far as he can among his fellows a spirit of dissatisfaction and unrest. The work he makes, as a rule, is of an unknown quantity and of a very inferior quality, and on the whole he is a very undesirable man to have in your employ. The presence of this class has a very demoralizing effect upon the better grade of men.

Second, the class constituted by those who have never received proper instructions when learning the trade, or that made a very poor use of the education received. They know very little about the art or mysteries of iron molding, and do not seem to want to learn, for in their own estimation they are properly qualified workmen and put up as many flasks as the good mechanic. But when their product is inspected and counted, there are nearly as many of their castings go back to the cupola to be remelted as go to the cleaning room, and what are accepted are of inferior quality. If you speak to them of their inefficiency and tell them how to improve their work or save more of it they put on a look of injured innocence and tell you that they are qualified workmen, who have worked at the business eight or nine years, and are too experienced at it to need instruction from any one. They are so thoroughly imbued with egotism and conceit as to make them useless to any manufacturer.

Third: There is still another class composed of workmen who are always learning, always on the alert to improve, who listen attentively and respectfully to any advice or instruction imparted by the foreman or superintendent, or even to any suggestions of their associate workmen, who take pride in producing good, light castings and who can be relied upon to produce at least 95 to 98 per cent good castings of all the work they put up on on their floors. You will find these men at work every day of the week and every month of the year that the foundry runs, unless prevented by sickness or accident. If they are sick and not in condition to come to the works, they always have the foreman informed of their condition, so that if necessary the work on their floors may be made by some of their associates. Their discounts in the cleaning room and mounting department are very small, and the mounter finds little or no trouble in putting their work together. Stoves, ranges and heaters made by them give satisfaction in every respect. Castings made from a proper mixture of iron, and to proper strain weight, seldom, if ever, break from fire when made by practical and competent workmen.

One of the secrets of producing competent workmen is in the selection of intelligent young men with the necessary qualifications, who with proper instruction and opportunities will aid in educating themselves in the mechanical knowledge of the trade. The applicant to learn a trade should be required to answer satisfactorily certain questions touching his future intentions as a workman, such as:

Are you desirous of becoming a good workman?

Are you willing to honestly devote four years of your time to learn and to master as far as possible the art of molding?

Will you implicitly obey the instructions of your foreman and instructor in all matters connected with your employment?

Will you at all times while in the foundry refrain from vulgar or profane language and from the use of intoxicating liquors, and discourage their use among your associates, not only inside the works, but at all times?

An apprentice should be taken on trial for a month to ascertain if he has the qualifications necessary for a capable workman, and the foreman or instructor should periodically report to the employer his fitness and conduct. If he be careless and show a disposition

not to apply himself and the foreman is of the opinion that he has taken a dislike to his occupation, and the interest he seemed to have at the beginning is on the wane, he should be discharged at once, as he has not the qualifications necessary for an efficient workman. If, on the contrary, he evinces an interest in his occupation and a desire to learn, the foreman should give him every opportunity possible, and by counsel, advice and instruction, assist him to secure the knowledge and skill he is in search of as rapidly as he is capable of receiving and applying it. He should receive encouragement from the superintendent and employer, who should take interest in the young man's efforts to become a good workman; should, when they meet, recognize him and inquire as to his progress; should stimulate him by words of praise for good conduct and application to business, and should spur his ambition to still greater efforts to become a good and skillful mechanic.

Some apprentices in the workshop, like boys in a school-room, learn much faster than others, and should be encouraged, for the faster they learn, the more profitable they become to their employers, and the more money they earn, and if their efforts are properly recognized, they will at a very early period approach to an equality with journeymen while still in their apprenticeship. If we desire to secure good and efficient workmen we must furnish those who learn the trade with competent and qualified instructors, to teach them its mysteries that lie hidden, so to speak, from the uninstructed in the brain of the qualified mechanic.

All foundries employing twelve or more apprentices should employ at least one thoroughly competent instructor, as it is impossible for a foreman with his manifold other duties, to find sufficient time to give that number of young men the instruction and advice necessary to enable them to become good workmen. If from neglect on the part of the employer, apprentices are allowed to do and go largely as they please, of necessity when their time has expired, many of them will be found among the worthless class of journeymen mentioned above.

The utmost care should be taken in the selection of foremen and instructors who have apprentices to educate; they should be thorough mechanics, competent and willing to instruct the apprentice by imparting to him the knowledge they themselves are possessed of, in a manner that will not be offensive. They must be men of good moral habits and reputation, and their every-day life, both in the works and outside, should be such as to challange criticism for moral rectitude and sobriety.

The instructor should also possess a knowledge of how to instruct so as to secure the best results. He should be a judge of human nature, and when any pupil is worthy he should be advanced by placing him on a floor located between two good workmen who will take interest in him and give him instructions and advice. All such cases of promotion and merit should be used as an incentive to spur others on to greater efforts by calling their attention to the rapid advancement of their associate.

The apprentice should be strictly trained in the proper care of his patterns and tools, seeing that they are kept neat, clean and free from rust; to have a place on the floor for everything used; to observe proper discipline and to treat each other with respect. When he shows too great anxiety to make money on work he is accustomed to, by neglecting to do it well, he should be corrected, and if he still persist, call a halt on him by discounting all inferior work.

The apprentice should be indentured for the term of four years. The employer should feel in honor bound to give him a thorough and practical knowledge of the business if the young man applies himself, and carries out the instructions given him. It is also the duty of the employer to see and know that the instructor is doing his full duty in teaching the apprentices.

The method of indenturing will vary, as some of the States have no laws governing apprentices, and some that have laws on the subject, are very unsatisfactory. As far as my knowledge extends,

I would recommend the adoption of a contract with the young man, agreeing to pay him so much per week in wages, payable weekly or upon the ordinary pay day of the establishment, and a promise of a certain sum of money per week as a bonus to be paid at the expiration of his term of apprenticeship, provided he continues in the service and performs his duties faithfully during the four years. In case he is discharged for cause, such as neglect in performing his work, drunkenness, quarreling or fighting, he forfeits all claims to such bonus. Or it may be arranged that the apprentices work by the piece after the first trial month, for during that time he has been taught the rudiments of his trade, such as shoveling and riddling sand, keeping tools and patterns in good order, tucking bars thoroughly, and ramming up flasks containing simple work in a proper manner. He can be given simple, plain molding to begin upon, and advanced when he has shown that he is making progress, so that from the time he begins work he will earn equal, if not greater wages by the piece than he would have received by the week, and he has it in his power to increase his pay from time to time by the acquirement of increased skill and dexterity.

In working by the piece he should be paid a certain percentage of the price paid the journeyman molder, and in addition thereto, a bonus of a given percentage on the amount of money earned by him during the term of his apprenticeship, payable as in the case of weekly wages, at the expiration of his term of service, provided he has performed his duty and has fulfilled the terms of his contract.

Let the wage system be what it will, it is very essential that the employer should take an interest in the young man, and see to it that he is properly treated and given every opportunity to become a skillful workman. He should see to it personally that the instructor is doing his duty. The apprentice should have every access to his employer who should hear him patiently and insure him at all times just treatment, and he should be encouraged to save his earnings, so that when he becomes a mechanic he will feel thankful for the interest taken in his welfare.

The apprentice system, as it has existed for the past thirty years, has been a source of annoyance and trouble to a great many manufacturers and of discouragement to the apprentice, for which to a very great degree, the manufacturer on the one hand, and the Molders' Union on the other, are responsible. Apprentices have not been properly instructed. Employed for the term of four years, during the time of their apprenticeship, they often do not learn to make more than six or eight different pieces of castings, and when as journeymen they are called upon to make a class of work different from what they have formerly made, they are lost, so to speak, and are unable to produce good work, so that they are compelled to search for jobs such as they have made and they become known as specialty workmen.

Since the close of the war and up to 1888, some two years after the organization of the Stove Founders' National Defense Association, there had been continual strife of warfare between the Molders' Union and the majority of manufacturers; the union making unreasonable and unjust demands as to prices that should be paid for labor, and the enforcement of rules that were destructive of discipline and good order in any establishment, and the manufacturer resisting such glaring injustice so that there were continual strikes, and all means, fair and unfair, were used by both parties to accomplish the defeat of the other side. The union thinking and scheming how to make a success of their strike, would persuade the indentured apprentice to quit the service of his employer by agreeing to take him into the union and making him a full-fledged union man, and putting into his hand a union card, although not having been employed at the business more than ten months or a year, and certainly not a journeyman molder. Some members of the union may deny this statement, but they are either ignorant of the facts, or tell a falsehood to try to cover up the dishonorable and unmanly action of

their unions. As the writer personally knows, eleven of his apprentices were taken into the union during the strike in his shop in 1884, some of whom had worked at the business less than nine months, the production of what is known as the "hobo" and the inefficient, know-nothing workman is therefore directly traceable in a measure to the selfishness and neglect of the employer in not giving the apprentice proper instructions, but more generally to the dishonorable practices of the Molders' Union in inducing apprentices to leave their employers, and by forcing on the trade with union cards in their pockets, men utterly worthless as molders. But we are now looking forward to a brighter future, and the production of a superior class of workmen; for since the organization of the Defense Association of Stove Manufacturers, the Iron Molders' Union has in the case of its members abandoned strikes as a remedy for the differences that arise, lets reason, justice and common sense prevail in the settlement by arbitration of all disputes.

Having given the subject of good and poor workmen some considerable thought during the forty-three years I have been engaged in the foundry business, eighteen of which was spent as an iron molder, working by the day or by the piece, as the occasion demanded, my opportunities for securing authentic information have been greater than many of those of my associate manufacturers, or of the ordinary workmen, and my experience proves that the apprentice who serves his time, and by carelessness on his own part or neglect on the part of his employer to properly instruct him, fails to become a qualified workman, loses at least 40 per cent. of his earning capacity as compared with that of the good workman. I have watched with interest the respective earnings of the two classes, and find that the average wages earned by the poor hobo and his companion, Mr. Know-it-all, to be from $2 to $2.50 per day by the piece, and that of the good workman, from $3.50 to $4 per day; therefore, both being physically able to perform the labor required, the good workman being employed 11 months in the year of 26 days each, would earn, at an average of $3.75 per day, $1,072.50, whereas the poor workman working the same number of days at an average of $2.25 earns only $643.50, or a difference of $429 per annum against the poor workman. This loss is not confined to one year alone, but continues with him as long as he remains in the business, and if the average number of years he works is fifteen, he is a loser to the amount of $6,435. This is food for thought to both the apprentice and the manufacturer. If the incompetent workman who, for reasons given, is in fifteen years a loser of $6,435, how much does the manufacturer lose by his employment when he occupies the same floor space as the good workman, but produces a little more than half the amount of castings, and those of an inferior quality, but using about the same number of pounds of melted iron daily to pour his molds? The capacity of the manufacturer is reduced to that extent besides the loss of remelting the large percentage of bad castings made.

If we can teach the apprentices that they can earn $429 more a year by becoming good and efficient workmen, it will not only stimulate them to acquire a more thorough and systematic knowledge of their business, but at the same time will prove to the employer that there is a large profit to him in turning out good workmen, and it will be a long stride in the right direction. Neither is engaged in the business for the sake of the trade or occupation, but solely for the money it gives. I am convinced that when this subject is taken hold of by employers and properly presented to the young men who are learning trades, an influence will be brought to bear on them that will bring forth good results in the near future, but it must be borne in mind that to secure such results the apprentice should thoroughly learn to make all the work, and especially the most difficult in the foundry in which he is learning his trade.

It is a fact known to all that professional men are making rapid advances perfecting themselves by study and experience in their various professions, but the condition of the mechanic has been quite the reverse, except in isolated

cases. This is not a healthy condition of affairs. There is no good reason why the mechanic should not improve and become as skillful in the different trades and as thorough a master of his calling as it is possible for the professional man to attain in his vocation. And we, as manufacturers, should all agree from this time forth to try and improve the standard of our workmen by giving encouragement to our apprentices, by furnishing them better facilities, and by assisting them to improve the opportunities as they arise.

If the work of the apprentice is changed as fast as he becomes proficient and continues to turn out perfect castings for weeks successively, it will enable him to improve, and will encourage him to become more skillful, and if properly followed up until he can satisfactorily make the most difficult work in the foundry, he will help to reduce this great army of incompetents hereinbefore mentioned, and at the same time will greatly assist in securing a large increase of good and efficient workmen in the line of our manufacturers.

Noisy.

THE girl who was not beautiful but interesting, displayed animation.

"I would greatly prefer," she was saying, "a quiet wedding, but it is impossible."

The maiden with a low, broad forehead, upon which the auburn curls clustered despite the humidity of the atmosphere, turned in surprise.

"Why impossible?" she asked.

"Because—"

Her look was one of calm resignation.

"—dear George is so hard of hearing, poor fellow."

It appeared to be a case of necessity. —*Detroit Tribune.*

The Berlin Iron Bridge Co., paid on April 14, their regular quarterly dividend of 1½%. Considering the hard times in all branches of business, especially among manufacturers of structural iron, we think this shows pretty good management—not to put it any stronger—and is a refreshing change in reports coming from so many quarters, of closed factories and "passed" dividends.

NOTICE.

Advertisements inserted under this head for 25 cents a line each insertion.

WANTED—A patternmaker with some capital as partner in an iron foundry in St. Louis, Mo.. Write J. Mac. Cash, 619 Harris ave., St. Louis, Mo.

WANTED—A good practical foundryman with some capital to invest in an established business as partner. Other partner engaged in boiler-making business that uses a great many castings. John T. this office.

FOR SALE.—Foundry, jobbing and repair shop; in a lively, growing city with a good country. Address, Wm. Engbring, Cedarburg, Wis.

A Safe Advertisement.

THE Smith Pattern Works of Akron, O., are not satisfied with having a good thing in their fillet, but are determined to let the rest of the world know it. They have recently been sending their friends and customers a handsome match safe, in the construction of which their fillet is shown to advantage, illustrating how, in many cases, it can be used to ornament and improve the appearance of a casting and take the place, at times, of hand carving.

Obituary.

Emil C. Hammer, of Boston, Mass., treasurer of the Branford Malleable Iron Co., dropped dead of heart disease in a Branford (Conn.) railroad station April 12.

He was a native of Denmark, 68 years old and was a self-made man, dying very wealthy. A year or two before the war broke out he, together with his brother, organized the Branford Iron Co., and afterwards with others started the United States Watch Co., at Waltham, and was the principal owner, and for ten years up to two years ago was treasurer of the Walworth Manufacturing Co.

Timothy W. Getman, formerly a partner of George R. Meneely in the brass foundry business, West Troy, N. Y., died suddenly April 16, in New York City.

New Foundry Enterprises.

J. W. Veness has erected a foundry 30x70 feet, at Albert Lea, Minn.

The Baker Wagon and Chain Co., are building a foundry at Elwood City, Pa.

North Bros. will build a foundry 103x121 ft. in Philadelphia, Pa.

The American Steel Foundry Co. have been incorporated to make steel castings of all kinds, the principal office being at Granite City, Ind.

A Theory of Ornamental Design Applied to the Decoration of Stoves.

BY JOS. LEON GOBEILLE.

TO most of you the title of this paper will express exactly what we will discuss in the few moments allotted to us. You will see that it is really two subjects: "A Theory of Ornamental Design," and Practical Application of Same to Stove Decoration." Between the two a gap occurs, which for various reasons, some of them obvious enough, we will leave open for another occasion.

The theory is simply an enlargement of the Newtonian suggestion that color and sound are, if not synonomous terms, at least so closely related as to be subject to like laws and like limitations. What we wish to show at this time is that Form is included with Sound and Color, especially as understood when we speak of ornamental details. And when we speak of Form we will take Webster's first definition—"The shape or external appearance of a body or figure as defined by lines and angles."

No one here will question that the effect of forms upon the eye is discordant or harmonious, according as their outlines and embodiment are agreeable or the contrary, to that sensibility which we call Good Taste. The truth of this proposition will be apparent without argument.

It may also be set down that the perfection of Art in Form is that rich simplicity which attracts or repels the rudest minds. Out of many examples of the effect of simple lines to influence the mind of man, two have been selected, which will be instantaneous in their action upon each one of you. Remember, they are an arrangement of elements, so primitive as to come below any written or picture language. It would be remarkable if everyone here should agree with me as to what arrangement of lines into form is today the most potent symbol in the United States, attractive or repellant, as the case may be, yet that is precisely what you will do. It is shown in diagram marked Exhibit "A."

It does not seem an easy task to select another composition as the second most affective and well-understood design known. It is not an acorn, nor a diamond, nor even a garland, and yet, as in the design of the cross, each one of you will agree that we have selected the arrangement of straight and curved lines, which deserves to rank as a good

Exhibit A.

second in this country. (Exhibit "B.")

Let us consider it settled, then, that certain arrangements of simple lines may be attractive or repellant if there be a proper basis for the design. The cross could be of no other shape and be effective. The dollar mark might possibly be, but its composition from the letters U. S., standing for "United States," stamps it as almost an inspiration.

To go one step forward in our argument it must be admitted that in the decoration of two similar objects, say stoves, the same elements may be used with equal skill, but unequal taste, the

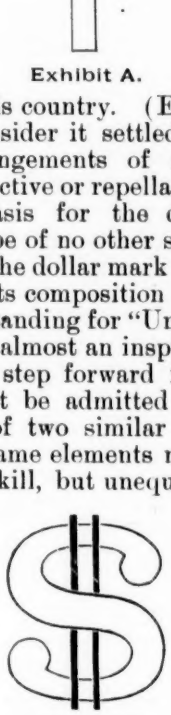


Exhibit B.

one being noble and attractive, the other ridiculous and repellant. We will take the liberty of using a well-known stove company's trade mark as an example of singularly felicitous adaption of simple elements in the diagram marked Exhibit "C." Now, we will show how the same

Exhibit C.

elements can be used to produce the op-

posite effect, that is, to repel, in diagram marked Exhibit "D."

So much by way of introduction, and now we will go along together in a popular view of some of the analogies of Color and Sound.

Those among us who have made a serious study of Design and Ornamentation know something of the difficulties in the way of making an explanation of the principles involved, which will be so interesting as not to trespass upon the indulgence of the average listener; but by avoiding technicalities and purely speculative propositions, everyone here may easily follow the procession of the argument.

We have little to do with Color in the

Exhibit D.

decoration of stoves, yet it will be profitable to take enough time to state some of the primary analogies between Color and Sound, expressed for convenience by the musical terms, tonic, medient and dominant (or the keynote, third and fifth of the scale), as shown in Exhibit "F." These in Color would be the three primaries, red, yellow, and blue, and to

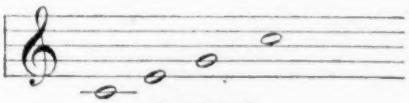


Exhibit F.

make this very plain and easily followed we will use a diagram showing these in the same position as if really musical notes. (Exhibit "G.")

Now, in music there are seven notes, four besides those mentioned, viz.: the super-tonic, the sub-dominant, the submedient and the sub-tonic, the eighth being, of course, the octave-tonic and therefore the commencement of a new series, but this presents no difficulties in the adaptation of the principle in color, for we have the proper notes for the four vacant spaces, viz.: orange, green, purple and neutral gray, or, according to Sir John D. McDonald, orange, green, indigo and violet. (Exhibit "H.")

The inclusive octave of both sound and color is very simply shown on paper and we think a harmonic unison established so that all will intuitively recognize it. (Exhibit "I.")

In Exhibit "J" we may see an octave on the piano-forte keyboard, with the corresponding tones of color properly located, and also their principal harmo-

R		Y		B			R

Exhibit G.

nies arranged in their natural sequences. This is according to the late G. G. Finn, and is not precisely the same arrangement as we have used, but it is practically identical, the difference being in the reading of the prismatic wave length.

It must not be thought that because authorities differ in minor matters regarding the scale of color, that there can be any question about the scientific arrangement.

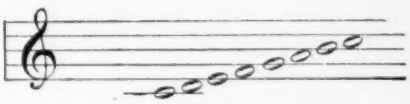


Exhibit H.

In regard to the difference above noticed, it can be very simply explained in this way: Blue and red mixed together mechanically produce for an intermediate pure purple, but there are other ways to get at the intermediate besides actually mixing colors; in the prism, for instance, the diffusion of the

R	O	Y	G	B	I	V	R

Exhibit I.

yellow ray causes two colors to be shown, indigo and violet. If we had the time, other apparent discrepancies could be explained on similar lines.

From the foregoing you will see that there is an analogy between the effects

produced upon the hearing and the seeing organs of sense, but the similarity is still more striking when you consider that both are produced by vibrations more or less rapid, the one striking the retina of the eye, the other the drum of the ear, tones of color or sound being pitched in exact accord with the number of vibrations per unit of time, as has been scientifically demonstrated, e. g., red, our tonic, is produced upon the retina of the eye by an atmospheric movement of four hundred and seventy-seven millions of millions (477,000,000,000,000) of vibrations per second, while the corresponding sound shown here as the middle "C" of our musical scale at concert pitch would be about two hundred and fifty-six (256) vibrations upon the drum of the ear for the same time, and the ratio remains almost constant from tonic to octave and from red to violet.

Gentlemen, this to me is a most fascinating subject. You will get tired of it before I do, but I will hasten all I can. It is quite possible that the future musical symphony or etude may be written out, not on a staff as now, but in colors representing homologous musical tones. These can be tinted and merged into each other until the effects, not now possible of expression in musical notation, may be faithfully and felicitously shown by a scheme of color. This has only been impracticable heretofore because we have had no artificial light which would enable an untrained eye to distinguish between certain colors and shades, such as blue and green, and indigo and violet. Now, however, with the electric light perfected to show all the various gradations of color, we may safely predict considerable activity in this field among scientific men in the near future. I have caused to be written a transcription of a grand old hymn in tones of color side by side with the accepted musical score and, lacking some better illustration, will attempt to show on my violin how the melody may be read and interpreted by means of the gradations and modulations as shown in the colored sketch. Notice the harmony of the tints and shadings to each other. Almost any good bit of musical harmony will work up with the same beauty and consistency in tones of color.

Now suppose we combine color and sound and apply our minds to the relation of form to this theory and see what its analogies are. In the beginning it might be well to remember that a constantly widening circle of designers believe that form in effect upon the eye is distinctly analogous to that of sound upon the ear, and that color is simply the sensual side of form, differing therefrom in quality only, as the rainbow differs from the mountain crag, and concordantly joining with form and sound, all together marching in the same methodical procession of the gamut: tonic, medient, dominant and tonic, and with the same constancy to the regular order of intervals in all the major and minor keys, while many go so far as to claim equal susceptibility to harmony, discord and effects of *Chiar-oscuro,* as for instance *piano, forte, crescendo* and *diminuendo.*

This being so, is it unreasonable for us to surmise that if one were sufficiently versed in the basic principles of form he might construct a scale of forms on identical lines with color and sound? Think a moment; music was commonly known long before the notes were decided or dreamed of. Colors were grouped harmoniously long before they were classified in their positions, though after the summer shower the orderly sequence of color was proclaimed in the beautiful segment across the heavens; may it not be true that all the primary elements of form have been used over and over again, in harmonious combinations, by persons of artistic temperament, judging correctly by intuition, when a demonstration quite as decisive as that of the Euclidian problems, was potentially present?

Let us see what some of the probabilities are: Certainly the harmonic triad is not lacking for expression in form or outline; the straight, crooked and curved line, as exhibited in the square, the elastic curve and the circle are in evidence. Again, if we look at form and sound in what might be termed their polite aspect, we find for the first, white, gray and black composing together the mono-

chrome, and in the second we have oratory, singing, and singing with instrumental or vocal accompaniment, or orchestration, while the structure of all musical sound bears out the theory of form in the tonic, the mediant and the dominant, all being used in quantity, arrangement and pitch to form a melody, precisely as the gamut of the rainbow may be distributed and re-united in various combinations and sequences to form harmonies, contrasts or discords; form, color and sound being equally dependent for effectiveness upon an identical harmonic triad.

Now, if arrangements of sound in combination produce a distinct harmony or discord, and if combinations of color follow precisely similar lines, is it not reasonable that form may obey the same laws as color and sound? Again, if these harmonies and discords in sound and color are capable of being analyzed and classified so that from their positions in a diagram or staff a deaf man may construct a melodious and pleasing combination of tones, or one born blind can produce a harmonious color scheme, how much more reasonable that a knowledge of the Newtonian theory of color and sound will enable one skilled therein to design beautiful ornamental combinations, quite independent of any natural or acquired taste for decoration; and, finally, if this person combines a scientific knowledge with a temperament susceptible to the effects of good or bad arrangements of elementary forms, such a one will of necessity compel recognition, as an expert designer, from all classes of people, especially from the educated and cultured, but with equal certainty from the rude and ignorant.

We have not the time to go into an elementary explanation of how we place before our very eyes a chromatic scale of applied forms—it is enough that you have followed thus far and understand the possibilities of such an application. We have gone on together to an orderly and popular examination of the principles involved, and now we will discuss very briefly the application of all this to the decoration of your productions.

For, after all (and notwithstanding your patience and attention), what you most desire to hear is some suggestion which will show how to arrange the lines of proportion and ornamentation of your stoves, as to produce in a measure the same effect upon the intuitive perceptions of the average prospective buyer that a scientific exposition would produce upon you or any other assembly of educated and cultured persons. Your goods ought to be so attractive that even the *persiflage* and hyperbole of a Fred Gardner, or a 'Hope Boal, would be "loves labor lost."

In the development of a systematic scheme of ornamentation such as has been outlined, many disappointments and non-sequences occur and conclusions must be carefully made. The man who pays only superficial attention to matters of art is usually free with his opinions, often couched in the form of an *ipse dixit,* but when one devotes a lifetime to reading and study and practice, then caution and conservatism become factors in the equation. As hinted in the beginning, I am not so sure of my ground as to warrant a graphical demonstration of the gamut of form in its complete fulfillment, but of the results obtained there will be no hesitancy in placing examples before you and inviting intelligent criticism. In the first place it is impossible to treat the formal decoration of stoves diatonically in the pattern as commonly constructed. The pattern must not be, in its original form, a wooden plate upon which is planted almost at random incongruous figures and shapes, miscalled ornaments, but on the contrary, the pattern proper and its decorative features should be an entity. It follows then that the completed model will be little more than a plastic sketch in clay or similar material. But there is another reason why this must be so—stoves are made of cast metal, which in process is a liquid. It is in waves and undulations while being poured, coming to rigidity very gradually; therefore, to be in unison, a similar substance must be used from which to fashion the model. Clay is not an ideal material by any means, but it is susceptible to manipulation and is the best thing known. It must first be treated for various weaknesses, particularly that of cracking

when dry. In Exhibit "M" five well-known methods are shown. First, the clay model; second, the wax model; third, the carved wood; fourth, the glue and white "compo."; and last, that friend-in-need of the man-without-an-idea, a bit of Lincrusta-Walton. The artistic superiority of the clay and wax models is in evidence.

Another mistake is to so design a piece of ornamental cast iron as to project details of any depth at right angles to the flow of the metal in casting; curves, gentle undulations and boldness, without distinct abruptness in the rise of the higher portions, is the desideratum.

As you would not overlay one opaque color upon another, nor in sound, place in juxtaposition two or more discordant notes, so in ornamentation the different elements should be amalgamated, or at least joined permanently. For example, tiles should be cast into your plates if you desire to use them, not fastened in with a frame.

Lettering ought to be sparingly used, and never merged into the design proper. After many experiments it seems that a brass letter cast into the plate is the most practical, and it is really very handsome. Above all avoid the so-called ornamental lettering put on in warts and patches. If you have anything to say in cast iron type, use an honest straightforward alphabet.

Our principle applied to the use of mica is rather bewildering, for it must be cast in the door, not fastened with a mica frame as now. And yet why not? Mica doors are the lightest parts of a stove, the easiest dismounted and replaced, thanks to the tin hinge tube. If the mica wears out why not allow the user the privilege of buying a new door, mica and all, from the original maker?

There is literally no end of changes necessary in your practice, if this diatonic scale is correct, but too much time has been taken already. In closing, permit me to thank you for your attention and to express the wish that at some time in the future I may be considered worthy to discuss with you some of the many really important matters relating to the design of ornamental patterns, from a practical standpoint, as we have done today, taking this theory as a basis to build upon.

A Live Institution.

PROBABLY none of the trite sayings of the day that have passed into proverbs by their fitness and constant use are considered more true than the one discrediting the impression that the race is always won by the swift and the battle by the strong.

In these days we think success generally crowns true merit coupled with a much-needed article called "hustle," all this comes to our mind as we learn of the more than ordinary prosperity these times of the Phœnix Iron Works, of Cleveland, O. For two months past they have been so busy that it has become necessary for them to work a double turn, running both night and day, and the prospects for the future appear equally as good.

They have recently installed a 60 h. p. electric motor to drive their machinery, and say that they find it better and cheaper and cleaner in every way than a boiler and engine.

In addition to this they have put in their own lighting plant. Among recent orders received they report six belt-power cranes for the Warren Foundry and Machine Co., Phillipsburg, N. J., and one 25-ton steam crane similar to one illustrated in their advertisement for the Erie Forge Co., Erie, Pa.

The Beauty of Niagara

Can never be described and it has never been pictured so adequately and satisfactorily as in the splendid portfolio just issued by the Michigan Central, "The Niagara Falls Route." It contains fifteen large plates from the very best instantaneous photographs, which cannot be bought for as many dollars. All these will be sent for ten cents, by FRANK J. BRAMHALL, Advtg. Agent, Michigan Central, 402 Monadnock Block, Chicago.